



## **README Document for**

**Global Land Data Assimilation System Version 1 (GLDAS-1) Products**

Prepared by Hualan Rui, GES DISC

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# Revision History

<i>Revision Date</i>	<i>Changes</i>	<i>Author</i>
08/21/2007	Initial version	Hongliang Fang
10/05/2007	Revise based on review	Hongliang Fang
03/05/2008	Add GDS service	Hongliang Fang
07/31/2008	Add VIC products, reprocessed monthly data	Hongliang Fang
05/15/2009	Add Data Services	Hongliang Fang
10/06/2009	Add Online Visualization and Analysis in Giovanni	Hongliang Fang
12/07/2009	Add Caveats section	Hongliang Fang
11/08/2010	Update two outdated links for GLDAS Forcing parameters	Hualan Rui
11/09/2010	Add a column into the Table 2 to indicate GLDAS Forcing parameters and modify the corresponding table description.	Hualan Rui
03/15/2011	Update the outdated links related to GLDAS-1 data migration from agdisc to hydro1.	Hualan Rui
21/11/2011	Update GES DISC Helpdesk email address	Hualan Rui

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### Caveats

*Dec 1, 2009.* An input parameter error for the 3-hourly products for CLM, Mosaic and Noah models covering August 1-13, 2009 was corrected and republished in October, 2009. Users of these products delivered in September, 2009 are recommended to download the republished data.

*Dec 1, 2009.* Due to uncertain data quality in the rainfall, pressure and humidity forcing data during mid 1995-1997, the soil moisture and other fields during this period are highly uncertain.

### Introduction

This document provides basic information on the land surface state (e.g., soil moisture and surface temperature) and flux (e.g., evaporation and sensible heat flux) parameters generated by the Global Land Data Assimilation System (GLDAS). GLDAS drives multiple, offline (not coupled to the atmosphere) land surface models, integrates a huge quantity of observation based data, and executes globally at high resolutions (2.5° to 1 km), enabled by the Land Information System (LIS) (Kumar et al., 2006). Currently, GLDAS drives four land surface models (LSMs): Mosaic, Noah, the Community Land Model (CLM), and the Variable Infiltration Capacity (VIC). More information is available at the [Land Data Assimilation Systems \(LDAS\)](#) and [Land Information System \(LIS\)](#) websites.

The temporal resolution for the GLDAS products is 3-hourly. Monthly products are also generated through temporal averaging of the 3-hourly products. Output files from these four models are briefly described here. Table 1 lists some basic characteristics of the GLDAS data.

**Table 1. Basic characteristics of the GLDAS data.**

Contents	Water and energy budget components, forcing data
Latitude extent	-60° to 90°
Longitude extent	-180° to 180°
Spatial resolution	0.25°, 1.0°
Temporal resolution	3-hourly or monthly
Temporal coverage	January 1, 1979 to present for the 1.0° data February 24, 2000 to present for the 0.25° data
Dimension	360 (lon) x 150 (lat) for the 1.0° data 1440 (lon) x 600 (lat) for the 0.25° data
Origin (1 <sup>st</sup> grid center)	(179.5W, 59.5S) for the 1.0° data (179.875W, 59.875S) for the 0.25° data
Land surface models	CLM 2.0, GLDAS/CLM experiment 691 (1.0°) MOSAIC, GLDAS/MOSAIC experiment 691 (1.0°) NOAH 2.7, GLDAS/NOAH experiment 691 (1.0°)

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	VIC water balance, GLDAS/VIC experiment 692 (1.0°) NOAH 2.7, GLDAS/NOAH experiment 881 (0.25°)
--	---

The data used by LIS include [parameter data](#) and [forcing data](#). All model simulations were initialized on January 1, 1979 using soil moisture and other state fields from the respective LSM climatology for that day of the year. The 1.0 degree resolution data range from 1979 to present for the four models. The 0.25 degree data cover 2000 to present from the NOAH model. The forcing data set combines multiple data sets for the period of January 1, 1979 to present:

1979-1993: bias-corrected European Center for Medium-Range Weather Forecasts (ECMWF) Reanalysis data (Berg et al., 2003)

1994-1999: bias-corrected National Center for Atmospheric Research (NCAR) Reanalysis data (Berg et al., 2003)

2000: NOAA/GDAS atmospheric analysis fields (Derber et al., 1991)

2001-present: a combination of NOAA/GDAS atmospheric analysis fields, spatially and temporally disaggregated NOAA Climate Prediction Center Merged Analysis of Precipitation (CMAP) fields, and observation-based downward shortwave and longwave radiation fields derived using the method of the Air Force Weather Agency's AGRicultural METeorological modeling system (AGRMET)

In NOAH experiment 881, snow cover data derived from the MODIS sensor aboard NASA's Terra satellite were assimilated in order to constrain the modeled snow water equivalent (SWE), using the updating technique described by Rodell and Houser (2004). SWE was adjusted when and where there was a discrepancy between the modeled SWE state (snow or no snow) and the MODIS snow cover state. A quantity of 10 mm SWE was added to pixels where the model did not have snow but the fractional MODIS snow cover was greater than 40%. Snow was removed from model pixels where MODIS indicated fractional snow cover was less than 10%.

### Updates

The initial release of the GLDAS LSM data is in three phases. Currently, with Phase 1 and Phase 2, users can access the data by searching and downloading via anonymous ftp or [Mirador](#). [Mirador](#), a Spanish word for a window offering an extensive view, uses keywords to find data quickly in a Google-like interface. Users can perform spatial and parameter subsetting and transform the data into netCDF format on-the-fly. The GLDAS data are also provided to GrADS Data Server (GDS) users via <http://hydro1.sci.gsfc.nasa.gov/dods/>. GDS users can access the data, perform subsetting and analysis operations without first downloading them. More advanced tools will be provided in Phase 3 and later releases, such as temporal aggregation in [Mirador](#), and an online visualization and analysis tool ([Giovanni](#)). [Giovanni](#) is a Web-based application developed by the GES DISC that provides a simple and intuitive way to visualize, analyze, and access vast amounts of Earth science remote sensing data without having to download the data.

Please check periodically the [GES DISC web site](#) for the latest GLDAS data.

## Data Citation

Please refer to Rodell et al. (2004) for more information about the GLDAS project.

NASA requests that you include the following acknowledgment in papers published using these data:

*"The data used in this study were acquired as part of the mission of NASA's Earth Science Division and archived and distributed by the Goddard Earth Sciences (GES) Data and Information Services Center (DISC)."*

We would appreciate receiving a copy of your publication, which can be forwarded to the following address:

GES DISC Help Desk  
Code 610.2  
NASA/Goddard Space Flight Center  
Greenbelt, MD 20771

## Data Organization

### *File Naming Convention*

#### 1. 3-hourly data set

For the 3-hourly data from the CLM, Mosaic and Noah models, the GLDAS files are named in accordance with the following convention:

GLDAS\_<Land surface model><LSM  
resolution>SUBP\_3H.A<date>.<HHHH>.<product version>.<Production date  
and time>.grb

The format for the date is <YYYY><Day of year>. The format for the production date and time is

<YYYY><Day of year><HHMMSS>

For example, the 1.0°×1.0° GLDAS data from NOAH model at 15:00Z on January 2, 1979 can be found in the file named:

“GLDAS\_NOAH10SUBP\_3H.A1979002.1500.001.2007159150213.grb”.

For the 3-hourly VIC data, the files are named with the following convention:

GLDAS\_<Land surface model><LSM  
resolution>\_3H.A<date>.<HHHH>.<product version>.grb

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For example, the file “GLDAS\_VIC10\_3H.A2008121.2100.001.grb” is of the 1.0°×1.0° VIC data at 21:00Z on April 30, 2008.

### 2. Monthly average data set

The monthly data are named in accordance with the following convention:

GLDAS\_<Land surface model><LSM resolution>\_M.A<date>.<product version>. grb

The format for the date is <YYYY><Month>. For example, the 1.0°×1.0° data from CLM model in January, 2007 are in the following file: “GLDAS\_CLM10\_M.A200701.001.grb”.

### *File Format Structure*

The GLDAS LSM data were created using the GRIdded Binary (GRIB) format. For more details about the GRIB format, please see <http://www.nco.ncep.noaa.gov/pmb/docs/on388/>.

Please note that GLDAS applies user-defined parameter tables (see Appendix B) for the GRIB files.

Users can also download the GLDAS products in netCDF format on-the-fly from the [Mirador](#) search and access tool. The converted netCDF files are compliant with the [Climate and Forecast \(CF\) metadata convention](#). For more details about the netCDF format, please see <http://www.unidata.ucar.edu/software/netcdf/>

### **Data Contents**

Table 2 shows a list of parameters provided in the GRIB files. This table shows the GRIB Product Definition Section (PDS) ID, the corresponding parameter name, the units, the time information, and the indication of Forcing parameters. The GLDAS data set includes predicted fields from the land surface models as well as input meteorological fields that were used as forcing. See the [Parameter Information Page \(PIP\)](#) for details about the parameters.

**Table 2. Geophysical parameters in the subsetted GLDAS data set**

<b>PDS IDs</b>	<b>Full Name</b>	<b>Unit</b>	<b>Time</b>	<b>Forcing Parameter</b>
001	Surface pressure	Pa	Instantaneous	Yes
011	Near surface air temperature	K	Instantaneous	Yes
032	Near surface wind magnitude	m/s	Instantaneous	Yes

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051	Near surface specific humidity	kg/kg	Instantaneous	Yes
057	Total evapotranspiration	kg/m <sup>2</sup> /s	Past 3-hr average	
065	Snow water equivalent	kg/m <sup>2</sup>	Instantaneous	
071	Total canopy water storage	kg/m <sup>2</sup>	Instantaneous	
085	Average layer soil temperature	K	Instantaneous	
086	Average layer soil moisture	kg/m <sup>2</sup>	Instantaneous	
099	Snowmelt	kg/m <sup>2</sup> /s <sup>1</sup>	Past 3-hr average	
111	Net shortwave radiation	W/m <sup>2</sup>	Past 3-hr average	
112	Net longwave radiation	W/m <sup>2</sup>	Past 3-hr average	
121	Latent heat flux	W/m <sup>2</sup>	Past 3-hr average	
122	Sensible heat flux	W/m <sup>2</sup>	Past 3-hr average	
131	Snowfall rate	kg/m <sup>2</sup> /s	Past 3-hr average	Yes
132	Rainfall rate	kg/m <sup>2</sup> /s	Past 3-hr average	Yes
138	Average surface temperature	K	Instantaneous	
155	Ground heat flux	W/m <sup>2</sup>	Past 3-hr average	
204	Surface incident shortwave radiation	W/m <sup>2</sup>	Instantaneous	Yes
205	Surface incident longwave radiation	W/m <sup>2</sup>	Instantaneous	Yes
234	Subsurface runoff	kg/m <sup>2</sup> /s	Past 3-hr average	
235	Surface runoff	kg/m <sup>2</sup> /s	Past 3-hr average	

<sup>1</sup>kg/m<sup>2</sup>/s for the CLM, Mosaic and VIC models and kg/m<sup>2</sup> for the Noah model (both 1.0° and 0.25 °).

The number of vertical levels for Soil Temperature (PDS 085) and Soil Moisture (PDS 086) is model specific. There are 10, 3, 4 and 3 layers for the CLM2, Mosaic, Noah, and VIC models, respectively.

The VIC simulation is in water balance mode and does not compute energy fluxes. Therefore the VIC data includes water budget components and forcing fields but without energy budget components (see the list of components at the [Parameter Information Page \(PIP\)](#)).

### Reading the Data

WGRIB, GrADS, or other GRIB readers are required for reading the GLDAS data. WGRIB is a program to manipulate, inventory, and decode GRIB files. The source code and installation instructions for WGRIB are available from <http://www.cpc.ncep.noaa.gov/products/wesley/wgrib.html>.

WGRIB version 1.7.X is recommended to avoid any possible discrepancies caused by different WGRIB versions. The GLDAS data set applies a user-specific parameter table to indicate the content and parameter number.

The Grid Analysis and Display System (GrADS) is an interactive desktop tool for easy access, manipulation, and visualization of earth science data. GrADS supports several data formats, such as binary, GRIB, NetCDF, and HDF. The documentation and software for GrADS can be found at <http://grads.iges.org/grads/>.

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### Set GLDAS-specific GRIB Parameter Table

GRIB files identify the contents (e.g., soil moisture, temperature) by parameter numbers. These numbers are linked to their respective parameter names in a parameter table. The parameter tables used for GLDAS data are shown in Appendices B.1~B.4, for each land surface model, respectively. The name of the user-defined table is searched for in the following order:

1. Environment variable "GRIBTAB"
2. Environment variable "gribtab"
3. File gribtab

Defining an environment variable depends on the operating system and on the shell.

Example:

```
set GRIBTAB=~/.data/gribtab          (MS-DOS or Windows)
export GRIBTAB=~/.data/gribtab       (bash)
setenv GRIBTAB ~/.data/gribtab       (csh)
GRIBTAB=$HOME/.data/gribtab; export GRIBTAB  (sh)
```

### Sample WGRIB Usage

Download the GRIBTAB and set the environmental variables (See Appendix B) first before using wgrib! By default, WGRIB uses the NCEP parameter tables instead of the GLDAS ones.

1. GRIB data verbose inventory

Usage: ./wgrib [grib file] [options]

Example:

```
wgrib GLDAS_CLM10SUBP_3H.A2007121.0000.001.2007297114034.grb -v > t
```

1:0:D=2007043021:SWnet:sfc:kpds=111,1,0:0-3hr ave:"Net Shortwave Radiation	W/m^2
2:37204:D=2007043021:LWnet:sfc:kpds=112,1,0:0-3hr ave:"Net Longwave Radiation	W/m^2
3:72510:D=2007043021:Qle:sfc:kpds=121,1,0:0-3hr ave:"Latent Heat Flux	W/m^2
4:109714:D=2007043021:Qh:sfc:kpds=122,1,0:0-3hr ave:"Sensible Heat Flux	W/m^2
5:146918:D=2007043021:Qg:sfc:kpds=155,1,0:0-3hr ave:"Ground Heat Flux	W/m^2
6:184122:D=2007050100:Snowf:sfc:kpds=131,1,0:anl:"Snowfall rate	kg/m^2/s
7:221326:D=2007050100:Rainf:sfc:kpds=132,1,0:anl:"Rainfall rate	kg/m^2/s
8:258530:D=2007050100:Evap:sfc:kpds=57,1,0:anl:"Total Evapotranspiration	kg/m^2/s
9:293836:D=2007050100:Qs:sfc:kpds=235,1,0:anl:"Surface Runoff	kg/m^2/s
10:331040:D=2007050100:Qsb:sfc:kpds=234,1,0:anl:"Subsurface Runoff	kg/m^2/s
11:368244:D=2007043021:Qsm:sfc:kpds=99,1,0:0-3hr ave:"Snowmelt	kg/m^2/s
12:380778:D=2007050100:AvgSurfT:sfc:kpds=138,1,0:anl:"Average Surface Temperature	K
13:412288:D=2007050100:SWE:sfc:kpds=65,1,0:anl:"Snow Water Equivalent	kg/m^2

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14:449492:D=2007050100:TSoil10:0-110 cm down:kpds=85,112,110:anl:"Average layer 10 soil temperature K  
15:481002:D=2007050100:TSoil10:0-109 cm down:kpds=85,112,109:anl:"Average layer 10 soil temperature K  
16:512512:D=2007050100:TSoil10:0-108 cm down:kpds=85,112,108:anl:"Average layer 10 soil temperature K  
17:544022:D=2007050100:TSoil10:0-107 cm down:kpds=85,112,107:anl:"Average layer 10 soil temperature K  
18:575532:D=2007050100:TSoil10:0-106 cm down:kpds=85,112,106:anl:"Average layer 10 soil temperature K  
19:607042:D=2007050100:TSoil10:0-105 cm down:kpds=85,112,105:anl:"Average layer 10 soil temperature K  
20:638552:D=2007050100:TSoil10:0-104 cm down:kpds=85,112,104:anl:"Average layer 10 soil temperature K  
21:670062:D=2007050100:TSoil10:0-103 cm down:kpds=85,112,103:anl:"Average layer 10 soil temperature K  
22:701572:D=2007050100:TSoil10:0-102 cm down:kpds=85,112,102:anl:"Average layer 10 soil temperature K  
23:733082:D=2007050100:TSoil10:0-101 cm down:kpds=85,112,101:anl:"Average layer 10 soil temperature K  
24:764592:D=2007050100:SoilM10:0-110 cm down:kpds=86,112,110:anl:"Average layer 10 soil moisture kg/m^2  
25:801796:D=2007050100:SoilM10:0-109 cm down:kpds=86,112,109:anl:"Average layer 10 soil moisture kg/m^2  
26:839000:D=2007050100:SoilM10:0-108 cm down:kpds=86,112,108:anl:"Average layer 10 soil moisture kg/m^2  
27:876204:D=2007050100:SoilM10:0-107 cm down:kpds=86,112,107:anl:"Average layer 10 soil moisture kg/m^2  
28:913408:D=2007050100:SoilM10:0-106 cm down:kpds=86,112,106:anl:"Average layer 10 soil moisture kg/m^2  
29:950612:D=2007050100:SoilM10:0-105 cm down:kpds=86,112,105:anl:"Average layer 10 soil moisture kg/m^2  
30:987816:D=2007050100:SoilM10:0-104 cm down:kpds=86,112,104:anl:"Average layer 10 soil moisture kg/m^2  
31:1025020:D=2007050100:SoilM10:0-103 cm down:kpds=86,112,103:anl:"Average layer 10 soil moisture kg/m^2  
32:1062224:D=2007050100:SoilM10:0-102 cm down:kpds=86,112,102:anl:"Average layer 10 soil moisture kg/m^2  
33:1099428:D=2007050100:SoilM10:0-101 cm down:kpds=86,112,101:anl:"Average layer 10 soil moisture kg/m^2  
34:1136632:D=2007050100:Canopint:sfc:kpds=71,1,0:anl:"Total canopy water storage kg/m^2  
35:1170040:D=2007050100:Wind:sfc:kpds=32,1,0:anl:"Near surface wind magnitude m/s  
36:1197756:D=2007050100:Tair:sfc:kpds=11,1,0:anl:"Near surface air temperature K  
37:1229266:D=2007050100:Qair:sfc:kpds=51,1,0:anl:"Near surface specific humidity kg/kg  
38:1245594:D=2007050100:PSurf:sfc:kpds=1,1,0:anl:"Surface pressure Pa  
39:1282798:D=2007043021:SWdown:sfc:kpds=204,1,0:0-3hr ave:"Surface incident shortwave radiation W/m^2  
40:1320002:D=2007043021:LWdown:sfc:kpds=205,1,0:0-3hr ave:"Surface incident longwave radiation W/m^2

The above inventory consists of several fields separated by colons. The contents of the fields are as follows:

1. Record number
2. Position in bytes
3. Date (YYYYMMDDHH)

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4. Parameter name (LAND=land/sea mask)
5. Type of level/layer (grib PDS octet 10)
6. KPDS5, KPDS6, KPDS7 (grib PDS octets 9, 10, 11-12)
7. Forecasts, analysis, etc.
8. Description of parameter type

Users are suggested to refer to the metadata associated with the GRIB files for more details about the Type of level/layer information.

### 2. Extract a specific field from GRIB data, e.g., Total Evapotranspiration

Usage: `wgrib -s infile | grep ":Evap:" | wgrib -i infile -o outfile`

For example:

```
wgrib -s GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb | grep ":Evap:" |  
wgrib -i GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb -o  
evap.1979002.0000.grb
```

To convert it into a text file:

```
wgrib -s GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb | grep ":Evap:" |  
wgrib -i -text GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb -o  
evap.1979002.0000.txt
```

A sample `evap.1979002.0000.txt` file looks like:

```
360 150  
9.999e+20  
9.999e+20  
9.999e+20  
9.999e+20  
9.999e+20  
9.999e+20  
9.999e+20  
...  
293.09  
293.9  
293.49  
293.55  
294.4  
294.53  
292.49  
293.51
```

The first line shows there are 150 (lines) by 360 (columns) number of grids globally from south to north. The real values are listed in one column. The filled value is 9.999e+20.

### *Preparation of GrADS Control File*

Set the environmental variables (See Appendix B) first before starting GrADS. For more information, please visit [grib2ctl home page](#).

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### 1. Make a GrADS control file for GRIB files

Usage: grib2ctl [options] [grib file] [optional index file] >[control file]

Example:

```
grib2ctl.pl GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb
>clm10.ctl
```

### 2. Create the "map" file for using GRIB data in GrADS

Usage: gribmap [options] [control file]

Example:

```
gribmap -e -i clm10.ctl
gribmap -o -i vic10.ctl
```

Hereunder is an example of a control file (clm10.ctl):

```
DSET ^GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb
INDEX ^GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb.idx
UNDEF 9.999E+20
TITLE GLDAS_CLM10SUBP_3H.A1979002.0000.001.2007219013746.grb
* produced by grib2ctl v0.9.12.5p33i
DTYPE grib 0
YDEF 150 linear -59.500000 1
XDEF 360 linear -179.500000 1.000000
TDEF 2 linear 21Z01jan1979 3hr
ZDEF 10 levels
110 109 108 107 106 105 104 103 102 101
VARS 22
  AvgSurfTsf 0 138,1,0 ** surface Average Surface Temperature K
  Canopintsfc 0 71,1,0 ** surface Total canopy water storage kg/m^2
  Evapsfc 0 57,1,0 ** surface Total Evapotranspiration kg/m^2/s
  LWdownsfc 0 205,1,0 ** surface Surface incident longwave radiation W/m^2
  LWnetsfc 0 112,1,0 ** surface Net Longwave Radiation W/m^2
  PSurfsfc 0 1,1,0 ** surface Surface pressure Pa
  Qairsfc 0 51,1,0 ** surface Near surface specific humidity kg/kg
  Qgsfc 0 155,1,0 ** surface Ground Heat Flux W/m^2
  Qhsfc 0 122,1,0 ** surface Sensible Heat Flux W/m^2
  Qlesfc 0 121,1,0 ** surface Latent Heat Flux W/m^2
  Qssf 0 235,1,0 ** surface Surface Runoff kg/m^2/s
  Qsbsfc 0 234,1,0 ** surface Subsurface Runoff kg/m^2/s
  Qsmsfc 0 99,1,0 ** surface Snowmelt kg/m^2/s
  Rainsfc 0 132,1,0 ** surface Rainfall rate kg/m^2/s
  SWEsfc 0 65,1,0 ** surface Snow Water Equivalent kg/m^2
  SWdownsfc 0 204,1,0 ** surface Surface incident shortwave radiation W/m^2
```

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```
SWnetsfc 0 111,1,0 ** surface Net Shortwave Radiation      W/m^2
Snowsfc 0 131,1,0 ** surface Snowfall rate                 kg/m^2/s
SoilM10dlr 10 86,112,0 ** Average layer 10 soil moisture   kg/m^2
TSoil10dlr 10 85,112,0 ** Average layer 10 soil temperature K
Tairsfc 0 11,1,0 ** surface Near surface air temperature  K
Windsfc 0 32,1,0 ** surface Near surface wind magnitude   m/s
ENDVARS
```

*Retrieve GLDAS data through the GrADS Data Server (GDS)*

Users can retrieve GLDAS data from a GDS server using analysis tools such as GrADS, Ferret, Matlab, or IDL. Here is an example of the GrADS script to access the GDS server and draw the Layer 10 soil moisture (soilm10) parameter from the CLM model.

```
'reinit'
'sdfopen
http://hydro1.sci.gsfc.nasa.gov/dods/GLDAS_CLM10SUBP_3H'
'set lon -180 180'
'set lat -60 90'
'set gxout grfill'
'set grads off'
'set t 1'
'd soilm10'
'draw title GLDAS CLM 3-Hourly 1.0 degree Average Layer 10 Soil
```

Users can convert the GLDAS data to ASCII or binary format on the fly, using a standard web browser through a constructed URL. For example:

```
http://hydro1.sci.gsfc.nasa.gov/dods/GLDAS_NOAH10_M.ascii?evap[0:1:1][91:1:93][81:1:85]
```

The output looks like:

```
evap, [2][3][5]
[0][0], 1.386E-5, 1.518E-5, 1.526E-5, 1.641E-5, 1.726E-5
[0][1], 1.577E-5, 1.554E-5, 1.56E-5, 1.628E-5, 1.786E-5
[0][2], 1.366E-5, 1.42E-5, 1.403E-5, 1.429E-5, 1.36E-5

[1][0], 1.691E-5, 1.694E-5, 1.69E-5, 1.864E-5, 2.04E-5
[1][1], 1.619E-5, 1.61E-5, 1.797E-5, 1.781E-5, 1.97E-5
[1][2], 1.495E-5, 1.556E-5, 1.655E-5, 1.718E-5, 1.742E-5

time, [2]
722451.0, 722482.0
lat, [3]
31.5, 32.5, 33.5
lon, [5]
-98.5, -97.5, -96.5, -95.5, -94.5
```

## Data Interpretation

Please see Appendix B for the user-defined parameter tables needed for interpreting GRIB files.

1. Due to the fact that forcing data for Greenland are unreliable and the lack of a glacier/ice sheet model, snow water equivalent accumulates indefinitely in Greenland and a few other Arctic points. Therefore it is highly recommended that Greenland and other points with abnormally large snow water equivalent values be masked out when performing global analyses.
2. Total precipitation is the sum of rainfall and snowfall.
3. Total runoff is the sum of subsurface runoff and surface runoff.
4. The number of vertical levels for soil moisture (SOILM) and soil temperature (TSOIL) is model specific. Please follow the table below for the correct depths of soil layers.

CLM 2.0 (10 layers)	
Depths	0-0.018, 0.018-0.045, 0.045-0.091, 0.091-0.166, 0.166-0.289, 0.289-0.493, 0.493-0.829, 0.829-1.383, 1.383-2.296, and 2.296-3.433 m.
MOS (3 layers)	
Depths	0-0.02, 0.02-1.50, and 1.5-3.50 m.
NOAH (4 layers)	
Depths	0-0.1, 0.1-0.4, 0.4-1.0, and 1.0-2.0 m.
VIC (3 layers)	
Depths	0-0.1, 0.1-1.6, and 1.6-1.9 m.

5. The generic GRIB table defines the different soil layers as SoilM1, ..., SoilMN, where  $N$  is the number of soil layers (See Appendix B).
6. Terrestrial water storage is the sum of soil moisture in all layers, accumulated snow, and plant canopy surface water.
7. Use temporal averaging, not accumulation, to upscale the data to different temporal resolutions. For example, rainfall and snowfall are provided as rates, i.e., kg/m<sup>2</sup>/s. So the correct method of upscaling is averaging, which does not change the units.
8. Monthly average files contain straight averages of 3-hourly data, so that each monthly average has units PER 3 HOURS. For example, total evapotranspiration (evap) for April 1979 is the average 3-hour mean rate of evapotranspiration over all the 3-hour intervals in April 1979. It is NOT the accumulated evapotranspiration in April 1979. To compute the latter, use this formula:

$$\text{total\_evapt (April)} = \text{evapsfc (April)} * 10800 \{ \text{sec/3hr} \} * 8 \{ 3\text{hr/day} \} * 30 \{ \text{days} \}$$

## Global Land Data Assimilation System (GLDAS) Products README

This would be irrelevant, and the above formula should not be used, if the field of interest were a state (e.g., soil moisture)

9. Heights of forcing fields depend on the data sets used to drive the simulation. Presently, all the GLDAS data sets use the 2 m temperature and specific humidity and the 10 m wind for the entire time span.

### Data Access

The NASA GES DISC maintains archives of all GLDAS data products and many other Hydrology data sets. The archived data can be accessed via FTP network transfer.

#### Data Volume

##### 1. 3-hourly data

Model	Resolution	Files/day	GB/year
CLM	1.0° × 1.0°	8	3.8
Mosaic	1.0° × 1.0°	8	2.3
Noah	1.0° × 1.0°	8	2.6
Noah	0.25° × 0.25°	8	42
VIC	1.0° × 1.0°	8	2.1

##### 2. Monthly data

Model	Resolution	Files/year	MB/year
CLM	1.0° × 1.0°	12	12.1
Mosaic	1.0° × 1.0°	12	9.0
Noah	1.0° × 1.0°	12	9.6
Noah	0.25° × 0.25°	12	153.6
VIC	1.0° × 1.0°	12	7.6

#### Search and Access System

GLDAS data can be accessed via the GES DISC's Hydrology Data and Information Services Center (HDISC)

<http://disc.gsfc.nasa.gov/hydrology>

Use the Mirador service to search and download GLDAS data in a batch mode (<http://mirador.gsfc.nasa.gov/>). Mirador is a fast interface for searching Earth science data at NASA GES DISC. In the Mirador interface, GLDAS data can be searched through a keyword (e.g., Noah) and the time span.

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The GLDAS products are provided to the GrADS Data Server (GDS) users via <http://hydro1.sci.gsfc.nasa.gov/dods/>. The GDS is a stable, secure data server that provides subsetting and analysis services across the internet. The GDS supports any operation that can be expressed in a single GrADS expression, including basic math functions, averages, smoothing, differencing, correlation, and regression.

### *Anonymous ftp*

The 3-hourly GLDAS data can be downloaded directly via the GES DISC anonymous ftp: [ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/GLDAS\\_V1/](ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/GLDAS_V1/).

The monthly GLDAS data can be downloaded from [ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/GLDAS\\_V1/](ftp://hydro1.sci.gsfc.nasa.gov/data/s4pa/GLDAS_V1/).

## Data Services

### *On-the-Fly (OTF) Parameter and Spatial Subset*

Users can subset the GLDAS products by a parameter and spatial region, before downloading them from the Mirador search and order tool. For example, a user selects three entire monthly GLDAS data sets from the Mirador tool and added them to the cart.

Service Selection		
Services are available for the files in the data set(s) you are adding to the cart. Services are performed on-the-fly as you download your data. No more than one service per data set can be selected for the files you are adding to the shopping cart.		
If you want to choose a service for a data set, click on the link for any of the services available for that data set, and you will be shown the options for that service from which you may select. To change the options for a service you have already selected, click on the link to that service in the Selected Service column.		
Once you have selected all of the services you want, click "Continue to Shopping Cart". If you do not wish to add anything to the shopping cart, click "Cancel" to return to your search results.		
Data Set	Selected Service	Available Services
GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_CLM10_M.001)	None	<a href="#">Subset Spatially and/or by Parameter...</a> <a href="#">Convert to NetCDF</a>
GLDAS Mosaic Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_MOS10_M.001)	None	<a href="#">Subset Spatially and/or by Parameter...</a> <a href="#">Convert to NetCDF</a>
GLDAS VIC Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_VIC10_M.001)	None	<a href="#">Subset Spatially and/or by Parameter...</a> <a href="#">Convert to NetCDF</a>
<a href="#">Continue to Shopping Cart</a> <a href="#">Cancel</a>		

And then, the user selects “Subset Spatially and/or by Parameter” from the list of “Available Services”. Clicking the “Subset spatially and/or by Parameter” button will pop up a window to allow users to select the parameter(s) and spatial region of interest to subset.

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Select subsetting criteria (Channels/Parameters/Bounding box) for the collection

South	53	West	-125
North	25	East	-87

GLDAS\_MOS10\_M001

Parameter Names

- Surface\_pressure
- Near\_surface\_air\_temperature
- Near\_surface\_wind\_magnitude
- Near\_surface\_specific\_humidity
- Total\_evapotranspiration
- Snow\_water\_equivalent
- Total\_canopy\_water\_storage
- Average\_layer\_soil\_temperature
- Average\_layer\_soil\_moisture
- Snowmelt
- Net\_shortwave\_radiation
- Net\_longwave\_radiation
- Latent\_heat\_flux
- Sensible\_heat\_flux
- Snowfall\_rate
- Rainfall\_rate
- Average\_surface\_temperature
- Ground\_heat\_flux
- Surface\_incident\_shortwave\_radiation
- Surface\_incident\_longwave\_radiation
- Subsurface\_runoff
- Surface\_runoff

Select subsetting criteria (Channels/Parameters/Bounding box) for the collection

Clicking the “Submit” button will move the “Subset Spatially and/or by Parameter” service to the “Selected Service” column.

## Global Land Data Assimilation System (GLDAS) Products README

**Mirador 1.28.1**  
Data Access Made Simple

**Service Selection**

Services are available for the files in the data set(s) you are adding to the cart. Services are performed on-the-fly as you download your data. No more than one service per data set can be selected for the files you are adding to the shopping cart.

If you want to choose a service for a data set, click on the link for any of the services available for that data set, and you will be shown the options for that service from which you may select. To change the options for a service you have already selected, click on the link to that service in the Selected Service column.

Once you have selected all of the services you want, click "Continue to Shopping Cart". If you do not wish to add anything to the shopping cart, click "Cancel" to return to your search results.

Data Set	Selected Service	Available Services
GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_CLM10_M.001)	Subset Spatially and/or by Parameter	No Service Convert to NetCDF
GLDAS Mosaic Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_MOS10_M.001)	Subset Spatially and/or by Parameter	No Service Convert to NetCDF
GLDAS VIC Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_VIC10_M.001)	Subset Spatially and/or by Parameter	No Service Convert to NetCDF

Continue to Shopping Cart Cancel

By clicking “Continue to Shopping Cart”, the user will see all selected files in the shopping cart. The “Checkout” button leads to a batch download interface for the subsetted files. The subsetted data are in the GRIB format, same as that of the original GLDAS products.

**Mirador 1.28.1**  
Data Access Made Simple

You are here: Keyword Search » Data sets from GLDAS search » Cart

Projects Keyword

**Shopping Cart - By Data Set Name** You have 1083 items (922.43 MB) in your cart

Sort by: Data Set Cart Options: Continue Searching Checkout Empty Cart

- GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS\_CLM10\_M v.001 Subset Spatially and/or by Parameter): 361 Items
- GLDAS Mosaic Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS\_MOS10\_M v.001 Subset Spatially and/or by Parameter): 361 Items
- GLDAS VIC Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS\_VIC10\_M v.001 Subset Spatially and/or by Parameter): 361 Items

Select All Reset Remove Selected Items From Cart

### *On-the-Fly (OTF) NetCDF Conversion*

The GLDAS data sets can be converted from GRIB format into netCDF format with the [Climate and Forecast \(CF\) metadata convention](#) through an on-the-fly (OTF) GRIB-to-netCDF conversion service. As an example, a user selects the monthly 1.0 degree CLM data set from the Mirador tool. A “NetCDF” button can then be clicked to download the file in netCDF format.

## Global Land Data Assimilation System (GLDAS) Products README

Projects
Keyword

Descriptive File Names: 
Sort by time:  
Descending ▼

File Listing For GLDAS\_CLM10\_M info
Results 1 - 15 for GLDAS\_CLM10\_M (1 second)

**GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree**

Services are available for the data set(s). Whenever you add files to the shopping cart, you will be presented with options for selecting a service and service parameters for any data set which has services.

Select All
Reset
Add Selected Items To Cart
Add All Files in All Pages To Cart

<input checked="" type="checkbox"/>	Select All	File Name	Start Time
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200901.001.grb ( 1.29 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2009-01-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200812.001.grb ( 1.30 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-12-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200811.001.grb ( 1.28 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-11-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200810.001.grb ( 1.28 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-10-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200809.001.grb ( 1.28 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-09-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200808.001.grb ( 1.28 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-08-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200807.001.grb ( 1.29 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-07-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200806.001.grb ( 1.29 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-06-01 00:00:00 <small>Metadata</small>
<input checked="" type="checkbox"/>		GLDAS_CLM10_M.A200805.001.grb ( 1.29 MB) <small>Download: <a href="#">GRIB (FTP)</a>   <a href="#">NetCDF</a></small>	2008-05-01 00:00:00 <small>Metadata</small>

Alternatively, a user can add all of the selected files into a shopping cart by clicking the “Add Selected Items to Cart” button and selecting “Convert to NetCDF” from the list of “Available Services.”

**Service Selection**

Services are available for the files in the data set(s) you are adding to the cart. Services are performed on-the-fly as you download your data. No more than one service per data set can be selected for the files you are adding to the shopping cart.

If you want to choose a service for a data set, click on the link for any of the services available for that data set, and you will be shown the options for that service from which you may select. To change the options for a service you have already selected, click on the link to that service in the Selected Service column.

Once you have selected all of the services you want, click “Continue to Shopping Cart”. If you do not wish to add anything to the shopping cart, click “Cancel” to return to your search results.

Data Set	Selected Service	Available Services
GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_CLM10_M.001)	None	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <span style="font-size: 0.8em;">🌐</span> Subset Spatially and/or by Parameter...                 </div> <div style="border: 1px solid black; padding: 2px;"> <span style="font-size: 0.8em;">🌐</span> Convert to NetCDF                 </div>

Continue to Shopping Cart
Cancel

## Global Land Data Assimilation System (GLDAS) Products README

Clicking the “Convert to NetCDF” button will move the “Convert to NetCDF” service to the “Selected Service” column.

**Service Selection**

Services are available for the files in the data set(s) you are adding to the cart. Services are performed on-the-fly as you download your data. No more than one service per data set can be selected for the files you are adding to the shopping cart.

If you want to choose a service for a data set, click on the link for any of the services available for that data set, and you will be shown the options for that service from which you may select. To change the options for a service you have already selected, click on the link to that service in the Selected Service column.

Once you have selected all of the services you want, click "Continue to Shopping Cart". If you do not wish to add anything to the shopping cart, click "Cancel" to return to your search results.

Data Set	Selected Service	Available Services
GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS_CLM10_M.001)	Convert to NetCDF	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;">  Subset Spatially and/or by Parameter...                 </div> <div style="border: 1px solid black; padding: 2px;">  No Service                 </div>

By clicking “Continue to Shopping Cart”, the user will see a list of files with the “.nc” suffix. The “Checkout” button leads to a batch download interface for the netCDF files.

Projects
Keyword

**Shopping Cart - By Data Set Name** You have 15 items (19.30 MB) in your cart

Sort by: Data Set Cart Options:

GLDAS CLM Land Surface Model L4 Monthly 1.0 x 1.0 degree (GLDAS\_CLM10\_M v.001 Convert to NetCDF): 15 Items

	File Name	Start Time
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200901.001.nc (1.29 MB) (No Image)	2009-01-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200812.001.nc (1.30 MB) (No Image)	2008-12-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200811.001.nc (1.28 MB) (No Image)	2008-11-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200810.001.nc (1.28 MB) (No Image)	2008-10-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200809.001.nc (1.28 MB) (No Image)	2008-09-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200808.001.nc (1.28 MB) (No Image)	2008-08-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200807.001.nc (1.29 MB) (No Image)	2008-07-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200806.001.nc (1.29 MB) (No Image)	2008-06-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200805.001.nc (1.29 MB) (No Image)	2008-05-01 00:00:00
<input checked="" type="checkbox"/>	GLDAS_CLM10_M.A200804.001.nc (1.28 MB) (No Image)	2008-04-01 00:00:00

Items 1 to 10 of 15 | [Next](#) | [Last](#)

The converted netCDF file can be processed with software packages such as GrADS, IDL, NCL, and HDFView. A sample netCDF descriptor file for GrADS users is attached in Appendix C.

## Global Land Data Assimilation System (GLDAS) Products README

### *Online Visualization and Analysis in Giovanni*

**Giovanni** is a Web-based application developed by the GES DISC that provides a simple and intuitive way to visualize, analyze, and access vast amounts of Earth science remote sensing data without having to download the data. All 1.0 degree monthly GLDAS parameters from the four land surface models are available from the [GLDAS instance](#) in Giovanni.

Users simply select one or more parameters, spatial and temporal ranges, and the visualization function. Seven visualization and analysis functions are available in the current instance: animation, lat-lon map (time-averaged), correlation map, lat-lon map (time-averaged differences), scatter plot, scatter plot (time-averaged), and time series. More advanced services will be added in the future.

In the example below, a user selects the global average layer 1 soil moisture from both Noah and VIC models for 2008. Then, the user selects the “lat-lon map of time averaged differences” function to examine the difference of layer 1 soil moisture estimated from the two land surface models.

# Global Land Data Assimilation System (GLDAS) Products README



+60  
[Advanced Search](#)

## Global Land Data Assimilation System

### 1.0 Degree Monthly Products

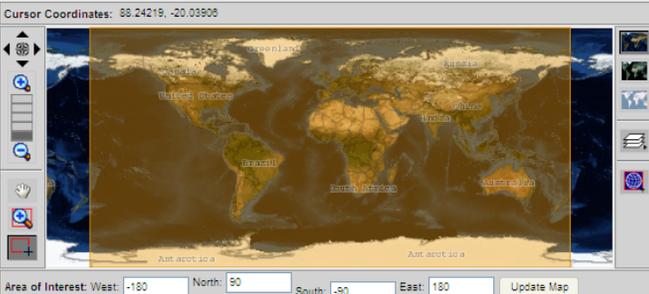
Home
Remove All

The Global Land Data Assimilation System (GLDAS) is generating a series of land surface state (e.g., soil moisture and surface temperature) and flux (e.g., evaporation and sensible heat flux) products simulated by four land surface models (CLM, Mosaic, Noah and VIC). Current data holdings include a set of 1.0 degree resolution data products from the four models, covering 1979 to the present; and a 0.25 degree data product from the Noah model, covering 2000 to the present. This instance focuses on the 1.0 degree monthly products.

Select:

Spatial

Cursor Coordinates: 88.24219, -20.03800



Area of Interest: West: -180 North: 90 South: -90 East: 180 Update Map

Parameters

Display:  Data Product Info  Units

Model	Parameter	Data Product Info	Model	Time Range
CLM Model (1979/01/01 - 2009/05/01)	<input type="checkbox"/> Average layer 10 soil moisture	GLDAS_CLM10_M_001	CLM Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 10 soil temperature	GLDAS_CLM10_M_001	CLM Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 1 soil moisture	GLDAS_CLM10_M_001	CLM Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 1 soil temperature	GLDAS_CLM10_M_001	CLM Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 2 soil moisture	GLDAS_CLM10_M_001	CLM Model	1979/01 - 2009/05
Mosaic Model (1979/01/01 - 2009/05/01)	<input type="checkbox"/> Average layer 1 soil moisture	GLDAS_MOS10_M_001	Mosaic Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 2 soil moisture	GLDAS_MOS10_M_001	Mosaic Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 3 soil moisture	GLDAS_MOS10_M_001	Mosaic Model	1979/01 - 2009/05
	<input type="checkbox"/> Average surface temperature	GLDAS_MOS10_M_001	Mosaic Model	1979/01 - 2009/05
	<input type="checkbox"/> Near surface air temperature	GLDAS_MOS10_M_001	Mosaic Model	1979/01 - 2009/05
Noah Model (1979/01/01 - 2009/05/01)	<input checked="" type="checkbox"/> Average layer 1 soil moisture	GLDAS_NOAH10_M_001	Noah Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 1 soil temperature	GLDAS_NOAH10_M_001	Noah Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 2 soil moisture	GLDAS_NOAH10_M_001	Noah Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 2 soil temperature	GLDAS_NOAH10_M_001	Noah Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 3 soil moisture	GLDAS_NOAH10_M_001	Noah Model	1979/01 - 2009/05
VIC Model (1979/01/01 - 2009/05/01)	<input checked="" type="checkbox"/> Average layer 1 soil moisture	GLDAS_VIC10_M_001	VIC Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 2 soil moisture	GLDAS_VIC10_M_001	VIC Model	1979/01 - 2009/05
	<input type="checkbox"/> Average layer 3 soil moisture	GLDAS_VIC10_M_001	VIC Model	1979/01 - 2009/05
	<input type="checkbox"/> Near surface air temperature	GLDAS_VIC10_M_001	VIC Model	1979/01 - 2009/05
	<input type="checkbox"/> Near surface specific humidity	GLDAS_VIC10_M_001	VIC Model	1979/01 - 2009/05

Temporal

Begin Date: Year 2008 Month Jan (Date Begin: Jan 1979)  
 End Date: Year 2008 Month Dec (Date End: May 2009)

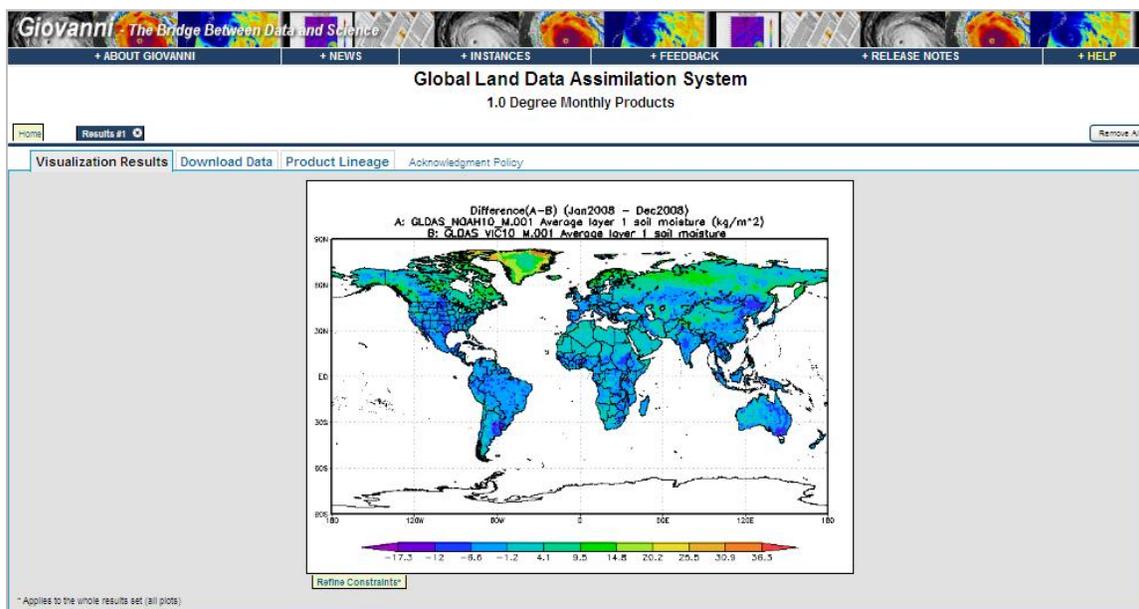
Select Visualization:

- Lat-Lon map of time-averaged differences
- Animation
- Lat-Lon map, Time-averaged
- Correlation map
- Lat-Lon map of time-averaged differences
- Scatter plot
- Scatter plot, Time-averaged
- Time series

[Edit Preferences](#)   [Visualization Help](#)  
 Official: Steven J. Kempley@nasa.gov / Drake (web-contact-dia)@listserv.gsfc.nasa.gov   [Contact Us](#)  
[Privacy Policy and Important Notices](#)

## Global Land Data Assimilation System (GLDAS) Products README

By clicking the “Generate Visualization” button, the user will see the resultant difference map of layer 1 soil moisture from the two models in 2008.



In addition to the visualization and analysis services, users can get GLDAS files in HDF, netCDF and ASCII formats by clicking the “Download Data” tab.

The screenshot shows the "Download Data" tab in the Giovanni web interface. It contains a yellow warning box at the top with the following text: "Download source data products and data products derived from Giovanni processing stages. For simplicity purposes, only the initial retrieval and final rendering phases are currently accessible for downloading. Supported download formats are HDF, NetCDF(NCD), ASCII, and KMZ (ASCII is available only when the array size is within about half-million points). To download multiple files at once, select the desired files (from any section) by clicking on their associated checkboxes, and then click 'Download in Batch'. Note: that 'n/a' means that a file size or other column value is not available; 'saa' means that a file is exactly the same as the previous one in the list. Also, not all services and data products support all download file formats." Below the warning box, there are two sections: "Initial Data Retrieval" and "Two Dimensional Map Plot". The "Initial Data Retrieval" section has a "Download in Batch" button and a table with columns for "Data Product", "Start Time", "File Size (b)", and "Download Files". The "Download Files" column has checkboxes for HDF, NCD, and ASC. The "Two Dimensional Map Plot" section also has a "Download in Batch" button and a table with columns for "Input Files", "Start Time", "File Size (b)", and "Download Files". The "Download Files" column has checkboxes for KMZ and KML.

Data Product	Start Time	File Size (b)	Download Files
GLDAS_NOAH10_M.001 (soilm1)	2008-01-01T00:00:00Z	1146062	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
GLDAS_NOAH10_M.001 (soilm1)	2008-02-01T00:00:00Z	1156389	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
GLDAS_NOAH10_M.001 (soilm1)	2008-03-01T00:00:00Z	1170539	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
GLDAS_NOAH10_M.001 (soilm1)	2008-04-01T00:00:00Z	1177421	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
GLDAS_NOAH10_M.001 (soilm1)	2008-05-01T00:00:00Z	1180123	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC
GLDAS_NOAH10_M.001 (soilm1)	2008-06-01T00:00:00Z	1177700	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC

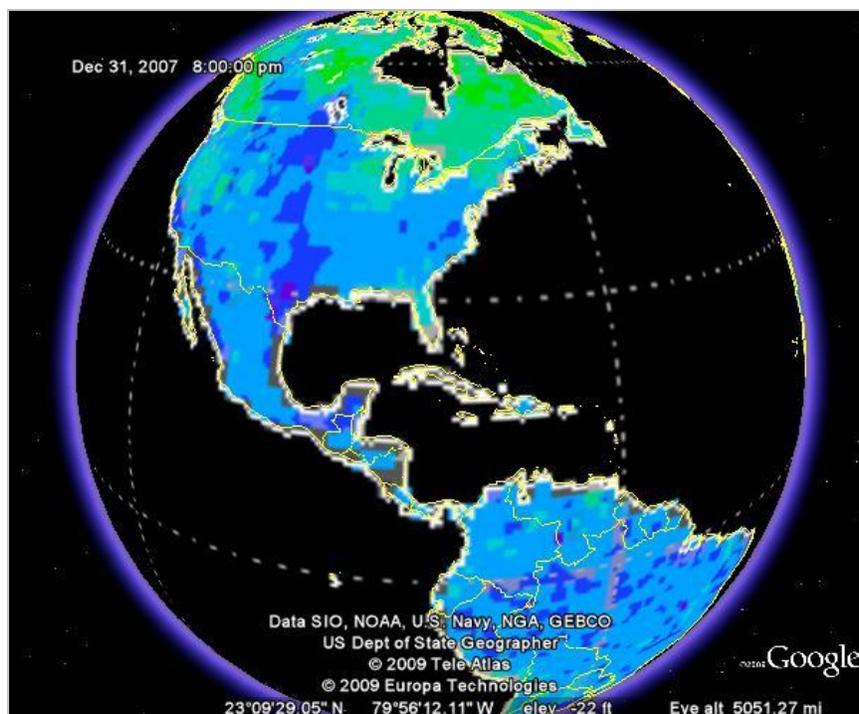
  

Input Files	Start Time	File Size (b)	Download Files
G3Dif#0 (g3_difference_0)	2008-01-01T00:00:00Z	220790	<input type="checkbox"/> HDF <input type="checkbox"/> NCD <input type="checkbox"/> ASC

Output Files	File Size (b)	Download Files
Difference_GLDAS_NOAH10_M.001_A_GLDAS_VIC10_M.001_B_2008-01_0001.gif	23587	<input type="checkbox"/> KMZ

Users can also view the GLDAS data in [Google Earth](#) by downloading the KMZ files under the “Download Data” tab. Below is the average layer 1 soil moisture difference map viewed in Google Earth.



More details about Giovanni can be found in the [Giovanni Online User Manual](#).

### Points of Contact

For information about or assistance in using any GES DISC data, please contact the GES DISC Help Desk at:

GES DISC  
Code 610.2  
NASA Goddard Space Flight Center  
Greenbelt, Maryland 20771  
Email: [gsfc-help-disc@lists.nasa.gov](mailto:gsfc-help-disc@lists.nasa.gov)  
301-614-5224 (voice)  
301-614-5268 (fax)

For general science questions and comments, please contact:

Hiroko Kato Beaudoin, M.S.  
Earth System Science Interdisciplinary Center  
University of Maryland, College Park  
Hydrological Sciences Laboratory, Code 617  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771  
Email: [Hiroko.Kato-1@nasa.gov](mailto:Hiroko.Kato-1@nasa.gov)  
Phone: 301-286-3951

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or

Matthew Rodell, Ph.D.  
Hydrological Sciences Laboratory, Code 617  
NASA Goddard Space Flight Center  
Greenbelt, MD 20771  
Email: Matthew.Rodell@nasa.gov  
Phone: 301-286-9143

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## Appendices

### A. Description of Metadata

**Table A.1. Collection level metadata**

Metadata items
C1. Collection data description
1. ShortName
2. LongName
3. TemporalRange
4. SpatialCoverage
5. DataResolution
6. Format (e.g., GRIB1)
7. LandSurfaceModel
8. LandSurfaceModelVersionID
C2. ScienceParameter group (Parameters listed in Table 2)

**Table A.2. Granule level metadata**

Metadata items
G1. General description
1. GranuleID
2. GranuleDate
3. LatitudeResolution
4. LongitudeResolution
5. Format (e.g., GRIB1)
6. SizeBytesDataGranule
7. LandSurfaceModel
G2. Grib data description
1. SouthernmostLatitude
2. NorthernmostLatitude
3. WesternmostLongitude
4. EasternmostLongitude
5. BeginningDateTime
6. EndingDateTime
G3. ScienceParameter Group

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1. ParameterShortName
2. ParameterLongName
3. Center
4. Subcenter
5. Process
6. Level (or Layer)
7. Height (or Pressure)
8. TimeRange
9. PeriodTime1
10. PeriodTime2
11. ForecastTimeUnit
12. GridSize
13. ForecastAnalysisFlag
14. NumberGridsAverage
15. MinValueData
16. MaxValueData
G4. Ingest information
1. ProductionDateTime
2. InsertDateTime

*B. User-defined Parameter Tables for Different GRIB Files*

Hereunder are the parameter tables used for GLDAS data. It is necessary to set the respective parameter table before using WGRIB or GrADS to read the data.

**Table B.1. GRIBTAB for CLM output (gribtab\_clm.txt)**

-1:-1:-1:-1		
111:SWnet:Net Shortwave Radiation	W/m <sup>2</sup>	
112:LWnet:Net Longwave Radiation	W/m <sup>2</sup>	
121:Qle:Latent Heat Flux	W/m <sup>2</sup>	
122:Qh:Sensible Heat Flux	W/m <sup>2</sup>	
155:Qg:Ground Heat Flux	W/m <sup>2</sup>	
131:Snowf:Snowfall rate	kg/m <sup>2</sup> /s	
132:Rainf:Rainfall rate	kg/m <sup>2</sup> /s	
057:Evap:Total Evapotranspiration	kg/m <sup>2</sup> /s	
235:Qs:Surface Runoff	kg/m <sup>2</sup> /s	
234:Qsb:Subsurface Runoff	kg/m <sup>2</sup> /s	
099:Qsm:Snowmelt	kg/m <sup>2</sup> /s	
068:DelSoilMoist:Change in soil moisture	kg/m <sup>2</sup>	
078:DelSWE:Change in snow water equivalent	kg/m <sup>2</sup>	
135:SnowT:Snow Temperature	K	
136:VegT:Vegetation Canopy Temperature	K	
137:BaresoilT:Temperature of bare soil	K	
138:AvgSurfT:Average Surface Temperature	K	
139:RadT:Surface Radiative Temperature	K	
084:Albedo:Surface Albedo, All Wavelengths	-	
065:SWE:Snow Water Equivalent	kg/m <sup>2</sup>	
085:TSoil1:Average layer 1 soil temperature	K	
085:TSoil2:Average layer 2 soil temperature	K	
085:TSoil3:Average layer 3 soil temperature	K	
085:TSoil4:Average layer 4 soil temperature	K	
085:TSoil5:Average layer 5 soil temperature	K	
085:TSoil6:Average layer 6 soil temperature	K	
085:TSoil7:Average layer 7 soil temperature	K	
085:TSoil8:Average layer 8 soil temperature	K	
085:TSoil9:Average layer 9 soil temperature	K	
085:TSoil10:Average layer 10 soil temperature	K	
086:SoilM1:Average layer 1 soil moisture	kg/m <sup>2</sup>	
086:SoilM2:Average layer 2 soil moisture	kg/m <sup>2</sup>	
086:SoilM3:Average layer 3 soil moisture	kg/m <sup>2</sup>	
086:SoilM4:Average layer 4 soil moisture	kg/m <sup>2</sup>	
086:SoilM5:Average layer 5 soil moisture	kg/m <sup>2</sup>	
086:SoilM6:Average layer 6 soil moisture	kg/m <sup>2</sup>	
086:SoilM7:Average layer 7 soil moisture	kg/m <sup>2</sup>	
086:SoilM8:Average layer 8 soil moisture	kg/m <sup>2</sup>	
086:SoilM9:Average layer 9 soil moisture	kg/m <sup>2</sup>	
086:SoilM10:Average layer 10 soil moisture	kg/m <sup>2</sup>	
070:RootMoist:Root zone soil moisture	kg/m <sup>2</sup>	
207:SoilWet:Total Soil Wetness	-	
210:TVeg:Vegetation transpiration	kg/m <sup>2</sup> /s	
200:ECanop:Interception evaporation	kg/m <sup>2</sup> /s	
199:ESoil:Bare soil evaporation	kg/m <sup>2</sup> /s	
071:Canopint:Total canopy water storage	kg/m <sup>2</sup>	
174:ACond:Aerodynamic conductance	m/s	

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032:Wind:Near surface wind magnitude	m/s
059:Rainfforc:Rainfall rate	kg/m <sup>2</sup> /s
064:Snowfforc:Snowfall rate	kg/m <sup>2</sup> /s
011:Tair:Near surface air temperature	K
051:Qair:Near surface specific humidity	kg/kg
001:PSurf:Surface pressure	Pa
204:SWdown:Surface incident shortwave radiation	W/m <sup>2</sup>
205:LWdown:Surface incident longwave radiation	W/m <sup>2</sup>

**Table B.2. GRIBTAB for MOSAIC output (gribtab\_mos.txt)**

-1:-1:-1:-1	
111:SWnet:Net Shortwave Radiation	W/m <sup>2</sup>
112:LWnet:Net Longwave Radiation	W/m <sup>2</sup>
121:Qle:Latent Heat Flux	W/m <sup>2</sup>
122:Qh:Sensible Heat Flux	W/m <sup>2</sup>
155:Qg:Ground Heat Flux	W/m <sup>2</sup>
131:Snowf:Snowfall rate	kg/m <sup>2</sup> /s
132:Rainf:Rainfall rate	kg/m <sup>2</sup> /s
057:Evap:Total Evapotranspiration	kg/m <sup>2</sup> /s
235:Qs:Surface Runoff	kg/m <sup>2</sup> /s
234:Qsb:Subsurface Runoff	kg/m <sup>2</sup> /s
099:Qsm:Snowmelt	kg/m <sup>2</sup> /s
068:DelSoilMoist:Change in soil moisture	kg/m <sup>2</sup>
078:DelsWE:Change in snow water equivalent	kg/m <sup>2</sup>
138:AvgSurfT:Average Surface Temperature	K
085:SoT:Deep Soil Temperature	K
084:Albedo:Surface Albedo, All Wavelengths	-
065:SWE:Snow Water Equivalent	kg/m <sup>2</sup>
086:SoilM1:Average layer 1 soil moisture	kg/m <sup>2</sup>
086:SoilM2:Average layer 2 soil moisture	kg/m <sup>2</sup>
086:SoilM3:Average layer 3 soil moisture	kg/m <sup>2</sup>
207:SoilWet:Total Soil Wetness	-
200:ECanop:Interception evaporation	kg/m <sup>2</sup> /s
210:TVeg:Vegetation transpiration	kg/m <sup>2</sup> /s
199:ESoil:Bare soil evaporation	kg/m <sup>2</sup> /s
070:RootMoist:Root zone soil moisture	kg/m <sup>2</sup>
071:Canopint:Total canopy water storage	kg/m <sup>2</sup>
174:ACond:Aerodynamic conductance	m/s
032:Wind:Near surface wind magnitude	m/s
059:Rainfforc:Rainfall rate	kg/m <sup>2</sup> /s
064:Snowfforc:Snowfall rate	kg/m <sup>2</sup> /s
011:Tair:Near surface air temperature	K
051:Qair:Near surface specific humidity	kg/kg
001:PSurf:Surface pressure	Pa
204:SWdown:Surface incident shortwave radiation	W/m <sup>2</sup>
205:LWdown:Surface incident longwave radiation	W/m <sup>2</sup>

**Table B.3. GRIBTAB for NOAH output (gribtab\_noah.txt)**

-1:-1:-1:-1	
111:SWnet:Net Shortwave Radiation	W/m <sup>2</sup>
112:LWnet:Net Longwave Radiation	W/m <sup>2</sup>
121:Qle:Latent Heat Flux	W/m <sup>2</sup>
122:Qh:Sensible Heat Flux	W/m <sup>2</sup>
155:Qg:Ground Heat Flux	W/m <sup>2</sup>
131:Snowf:Snowfall rate	kg/m <sup>2</sup> /s
132:Rainf:Rainfall rate	kg/m <sup>2</sup> /s

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057:Evap:Total Evapotranspiration	kg/m <sup>2</sup> /s
235:Qs:Surface Runoff	kg/m <sup>2</sup> /s
234:Qsb:Subsurface Runoff	kg/m <sup>2</sup> /s
099:Qsm:Snowmelt	kg/m <sup>2</sup> /s
068:DelSoilMoist:Change in soil moisture	kg/m <sup>2</sup>
078:DelSWE:Change in snow water equivalent	kg/m <sup>2</sup>
138:AvgSurfT:Average Surface Temperature	K
084:Albedo:Surface Albedo, All Wavelengths	-
065:SWE:Snow Water Equivalent	kg/m <sup>2</sup>
085:TSoil1:Average layer 1 soil temperature	K
085:TSoil2:Average layer 2 soil temperature	K
085:TSoil3:Average layer 3 soil temperature	K
085:TSoil4:Average layer 4 soil temperature	K
086:SoilM1:Average layer 1 soil moisture	kg/m <sup>2</sup>
086:SoilM2:Average layer 2 soil moisture	kg/m <sup>2</sup>
086:SoilM3:Average layer 3 soil moisture	kg/m <sup>2</sup>
086:SoilM4:Average layer 4 soil moisture	kg/m <sup>2</sup>
207:SoilWet:Total Soil Wetness	-
200:ECanop:Interception evaporation	kg/m <sup>2</sup> /s
210:TVeg:Vegetation transpiration	kg/m <sup>2</sup> /s
199:ESoil:Bare soil evaporation	kg/m <sup>2</sup> /s
070:RootMoist:Root zone soil moisture	kg/m <sup>2</sup>
071:Canopint:Total canopy water storage	kg/m <sup>2</sup>
032:Wind:Near surface wind magnitude	m/s
059:Rainfforc:Rainfall rate	kg/m <sup>2</sup> /s
064:Snowfforc:Snowfall rate	kg/m <sup>2</sup> /s
011:Tair:Near surface air temperature	K
051:Qair:Near surface specific humidity	kg/kg
001:PSurf:Surface pressure	Pa
204:SWdown:Surface incident shortwave radiation	W/m <sup>2</sup>
205:LWdown:Surface incident longwave radiation	W/m <sup>2</sup>

**Table B.4. GRIBTAB for VIC output (gribtab\_vic.txt)**

-1:-1:-1:-1	
111:SWnet:Net Shortwave Radiation	W/m <sup>2</sup>
112:LWnet:Net Longwave Radiation	W/m <sup>2</sup>
121:Qle:Latent Heat Flux	W/m <sup>2</sup>
122:Qh:Sensible Heat Flux	W/m <sup>2</sup>
155:Qg:Ground Heat Flux	W/m <sup>2</sup>
132:Rainf:Rainfall rate	kg/m <sup>2</sup> /s
131:Snowf:Snowfall rate	kg/m <sup>2</sup> /s
057:Evap:Total Evapotranspiration	kg/m <sup>2</sup> /s
235:Qs:Surface Runoff	kg/m <sup>2</sup> /s
234:Qsb:Subsurface Runoff	kg/m <sup>2</sup> /s
250:Qfz:Re-freezign of water in the snow	km/m <sup>2</sup> /s
239:SnowT: Snow temperature	K
138:AvgSurfT:Average Surface Temperature	K
149:RadT:Surface Radiative Temperature	K
084:Albedo:Surface Albedo, All Wavelengths	-
085:TSoil1:Average layer 1 soil temperature	K
085:TSoil2:Average layer 2 soil temperature	K
085:TSoil3:Average layer 3 soil temperature	K
086:SoilM1:Average layer 1 soil moisture	kg/m <sup>2</sup>
086:SoilM2:Average layer 2 soil moisture	kg/m <sup>2</sup>
086:SoilM3:Average layer 3 soil moisture	kg/m <sup>2</sup>

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210:TVeg:Vegetation transpiration	kg/m <sup>2</sup> /s
199:ESoil:Bare soil evaporation	kg/m <sup>2</sup> /s
207:SoilWet:Total Soil Wetness	-
070:RootMoist:Root zone soil moisture	kg/m <sup>2</sup>
065:SWE:Snow Water Equivalent	kg/m <sup>2</sup>
099:Qsm:Snowmelt	kg/m <sup>2</sup> /s
068:DelSoilMoist:Change in soil moisture	kg/m <sup>2</sup>
078:DelSWE:Change in snow water equivalent	kg/m <sup>2</sup>
179:Acond: Aerodynamic conductance	m/s
032:Wind:Near surface wind magnitude	m/s
059:Rainfforc:Rainfall rate	kg/m <sup>2</sup> /s
064:Snowfforc:Snowfall rate	kg/m <sup>2</sup> /s
011:Tair:Near surface air temperature	K
051:Qair:Near surface specific humidity	kg/kg
001:PSurf:Surface pressure	Pa
204:SWdown:Surface incident shortwave radiation	W/m <sup>2</sup>
205:LWdown:Surface incident longwave radiation	W/m <sup>2</sup>

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### C. Sample NetCDF descriptor file for GrADS users

```
dset ^GLDAS_CLM10_M.A200806.001.nc
undef -999.
title GLDAS_CLM10_M.A200806.001.nc
dtype netcdf
ydef 150 linear -59.500000 1
xdef 360 linear -179.500000 1.000000
tdef 1 linear 00Z01jun2008 lmo
zdef 10 levels 1 2 3 4 5 6 7 8 9 10
vars 22
AvgSurfT_0_SFC=>avgsurft_0_sfc 0 y,x ** surface Average Surface
Temperature K
Canopint_0_SFC=>canopint_0_sfc 0 y,x ** surface Total canopy water
storage kg/m^2
Evap_0_SFC=>evap_0_sfc 0 y,x ** surface Total Evapotranspiration
kg/m^2/s
LWdown_0_SFC_ave3h=>lwdown_0_sfc_ave3h 0 y,x ** surface Surface
incident longwave radiation W/m^2
LWnet_0_SFC_ave3h=>lwnet_0_sfc_ave3h 0 y,x ** surface Net Longwave
Radiation W/m^2
PSurf_0_SFC=>psurf_0_sfc 0 y,x ** surface Surface pressure
Pa
Qair_0_SFC=>qair_0_sfc 0 y,x ** surface Near surface specific
humidity kg/kg
Qg_0_SFC_ave3h=>qg_0_sfc_ave3h 0 y,x ** surface Ground Heat Flux
W/m^2
Qh_0_SFC_ave3h=>qh_0_sfc_ave3h 0 y,x ** surface Sensible Heat Flux
W/m^2
Qle_0_SFC_ave3h=>qle_0_sfc_ave3h 0 y,x ** surface Latent Heat Flux
W/m^2
Qs_0_SFC=>qs_0_sfc 0 y,x ** surface Surface Runoff
kg/m^2/s
Qsb_0_SFC=>qsb_0_sfc 0 y,x ** surface Subsurface Runoff
kg/m^2/s
Qsm_0_SFC_ave3h=>qsm_0_sfc_ave3h 0 y,x ** surface Snowmelt
kg/m^2/s
Rainf_0_SFC=>rainf_0_sfc 0 y,x ** surface Rainfall rate
kg/m^2/s
SWE_0_SFC=>swe_0_sfc 0 y,x ** surface Snow Water Equivalent
kg/m^2
SWdown_0_SFC_ave3h=>swdown_0_sfc_ave3h 0 y,x ** surface Surface
incident shortwave radiation W/m^2
SWnet_0_SFC_ave3h=>swnet_0_sfc_ave3h 0 y,x ** surface Net Shortwave
Radiation W/m^2
Snowf_0_SFC=>snowf_0_sfc 0 y,x ** surface Snowfall rate
kg/m^2/s
SoilM1_0_DBLy=>soilm1_0_dbly 10 z,y,x ** underground Average layer
soil moisture kg/m^2
TSoil1_0_DBLy=>tsoil1_0_dbly 10 z,y,x ** underground Average layer
soil temperature K
Tair_0_SFC=>tair_0_sfc 0 y,x ** surface Near surface air temperature
K
Wind_0_SFC=>>wind_0_sfc 0 y,x ** surface Near surface wind magnitude
m/s
ENDVARS
```

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### *D. Acronyms*

The following acronyms and abbreviations are used in this document.

AGRMET	Air Force Weather Agency's AGRicultural METeorological modeling system
CLM	Community Land Model
CMAP	Climate Prediction Center Merged Analysis of Precipitation
ECMWF	European Center for Medium-Range Weather Forecasts
GDAS	Global Data Assimilation System
GDS	GrADS Data Server
GES DISC	Goddard Earth Sciences Data and Information Services Center
Giovanni	GES-DISC Interactive On-line Visualization and Analysis Infrastructure
GLDAS	Global Land Data Assimilation System
GrADS	Grid Analysis and Display System
GRIB	GRIdded Binary
HDF	Hierarchical Data Format
HDISC	Hydrology Data and Information Services Center
LDAS	Land Data Assimilation System
LIS	Land Information System
LSM	Land Surface Model
MODIS	Moderate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
netCDF	network Common Data Form
NEWS	NASA Energy and Water Cycle Study
NOAA	National Oceanic and Atmospheric Administration
NOAH	National Centers for Environmental Prediction/Oregon State University/Air Force/Hydrologic Research Lab Model
OPeNDAP	Open Source Project for a Network Data Access Protocol
OTF	On-The-Fly
PDS	Product Definition Section
PIP	Parameter Information Page
SWE	Snow Water Equivalent
VIC	Variable Infiltration Capacity